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Manuals and tips

Fogra Monitor Test Pictures

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Fogra Monitor Test Pictures

A collection of test forms to visually assess monitor quality.

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1. General notes

1.1 Overview of criteria

The Fogra monitor test forms are suited to visually assess the following criteria

1. Viewing cone characteristics
2. Uniformity
3. Pixel failures
4. Artefacts like so called "Black Mura"
5. "Ghost pictures" (or sticky or persistent image)

The test forms are prepared in the PDF file "Fogra_ViewingAngleTest_1920x1200.pdf". They are available free of charge on the Fogra research website. The usage of the test forms is explained in this manual. The technical background why a specific test form is well suited to judge a specific criterion is not explained here.

1.2 Overview of the test pictures in the test file

The test file consists of 15 different test forms. They are arranged consecutively in a PDF file with each test form on a single page. In the following the test forms are labelled accordingly test form 1 to 15 (see table 1 and figure 1).

PDF page	Test form designation	Viewing cone characteristic	Uniformity	Pixel failure	Artefact "Black Mura"	"Ghost pictures"
1	Portrait	✓	✓			
2	Reflex	✓				
3	Watch 1	✓				
4	Watch 2	✓				
5	Stripes 1	✓	✓			
6	Stripes 2	✓				
7	White	✓	✓	✓		
8	Light grey	✓	✓			
9	Grey	✓	✓			✓
10	Dark grey	✓	✓			
11	Black	✓	✓	✓	✓	
12	Red			✓		
13	Green			✓		
14	Blue			✓		
15	Checker board					✓

Table 1: Overview of the test forms and the applicability to visually test specific criteria.

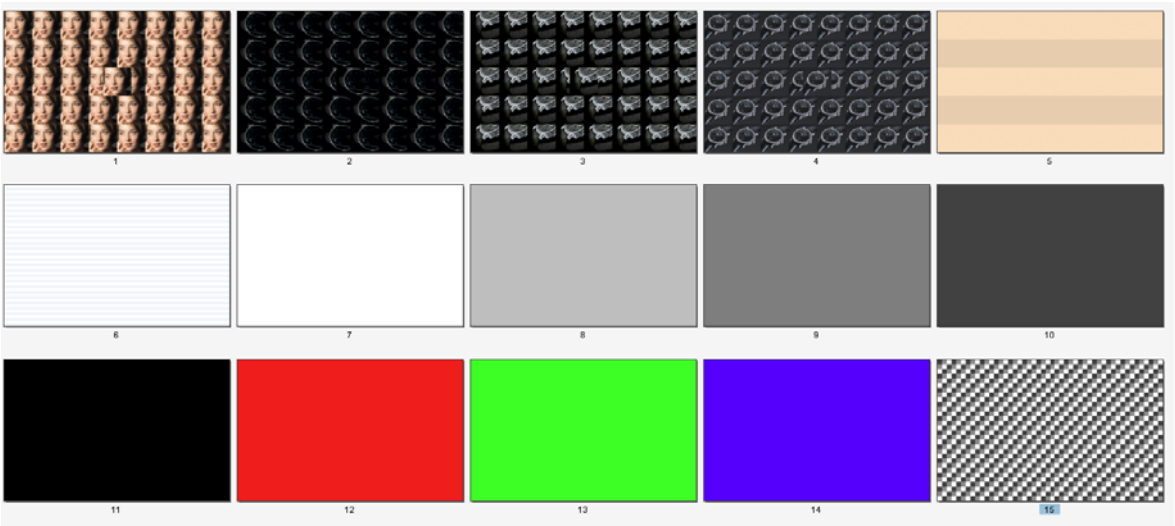

Figure 1: Overview of the 15 test forms.

The test forms can be classified in two groups. The first group uses photographic motives while the second group uses technical elements. One example for the first group and two examples for the second group will demonstrate the design and layout of the test forms for each group:

Test forms 1 to 4 belong to the first group and show a photographic content which is arranged in an equally spaced pattern from a repeated single image (see figure 2). Test form 1 shows a portrait, test form 2 shows a reflex in a mirror, while test forms 3 and 4 show watches on a dark background.

Figure 2: Test form 1, motive Portrait, to assess the viewing cone characteristics and uniformity of a monitor

The following test forms 5 to 15 contain technical elements and form the second group. Test forms 6 and 7 show a stripe motive (see figure 3).

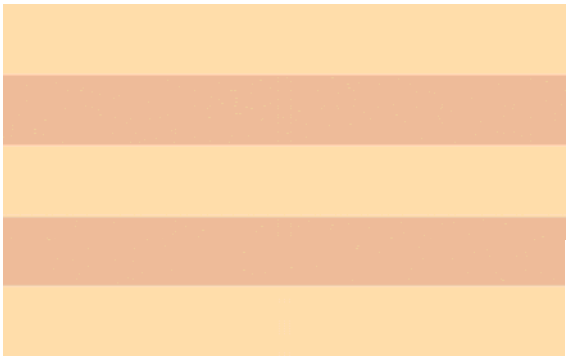

Figure 3: Test form 5, motive Stripe 1, to evaluate viewing cone characteristics and uniformity of a monitor.

Test forms 8 to 14 consist of simple full screen colours and are not demonstrated here, while the last test form (Page 15 of the PDF file) comprises a checker board pattern with black grey and white fields (see figure 4).

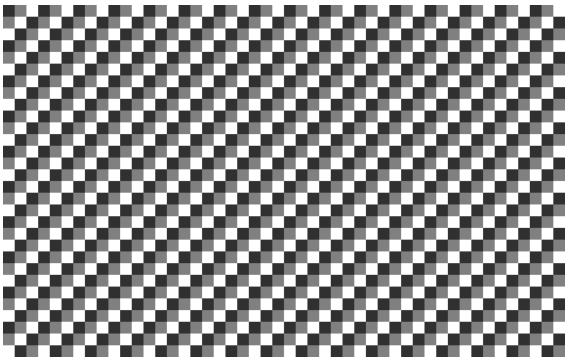

Figure 4: Test form 15, motive Checker board, to check for "Ghost pictures" (sticky images).

1.3 Displaying the test forms

The individual test forms, as single pages of the PDF document, have to be displayed in full screen mode. By opening the file in Acrobat Reader or Acrobat the file will trigger a prompt to display the file in full screen mode. The file resolution is optimized for monitors with a resolution of 1920 x 1200 pixels, but can be displayed on monitors with different resolutions. If needed the zoom factor can be changed with Ctrl-+ or Ctrl— (or the according key-combination with Command-Key on a Mac). Symmetric or unsymmetrical scaling of the test images is needed if the test images are presented on displays with a pixel resolution (and aspect ratio) differing from 1920x1200. Such a process does normally not constrain the visual evaluation.

1.4 Viewing conditions

When visually assessing the viewing characteristics of a monitor it is important to match the viewing conditions of the latter use case. An observer will be more sensible to small colour differences in dark tones ("shadows") when the monitor is used in ambient conditions with low lighting levels. Therefore choose the lower illuminance range for your test ambient condition, which is still typical for the daily

production use. In addition take care that no reflections from light sources (lamps or windows) can be observed on the monitor.

Choose a viewing distance, which is also typical for your use of the monitor. In general (desktop applications) the viewing distance is often between 45 cm and 80 cm. To assess several monitors one after the other under the same conditions one practical idea is to use the length of the arm to a fist just touching gently the monitor surface. This distance is about 60 cm for a 1,80 m height person.

In addition to do the testing under typical viewing conditions you might also use viewing conditions, which indicate possible problems for more demanding use cases, such as viewing the screen with two or three persons.

To assess the viewing angle characteristics of a monitor faster and easier it also can be an idea to change the viewing angle in horizontal, vertical or diagonal (by moving the head around) to a larger degree then in daily use. Keep in mind that the main focus of the appraisal should reflect the typical viewing conditions in daily production use.

1.5 Transferability of the results from a single sample to the model type

The viewing cone characteristics of a individual display normally does not show significant variations within an entire model series. Therefore testing a single sample can be seen to reflect the typical behaviour of the model type. Other criteria like uniformity, pixel failures, artefacts or "ghost pictures" have to be tested for each individual sample, since they might show larger variations within a production series. Last but not least those criteria (like uniformity) might change over the years due aging. It is a good idea to visually assess those criteria with the help of the test pictures once in a while or when getting doubts about the output.

2. Appraisal of the viewing cone characteristics

To assess possible changes of colour in hue, chroma and lightness as well as gradation ("gamma") over the viewing cone the first 4 test forms of the PDF should be used. In general colour differences between the centre test motive and the repeated motives in one of the 4 corners are most prominent. Most panel types exhibit a stronger colour shift in those areas.

Please be also cautious and check symmetry of the viewing cone characteristics. It is typical but not necessarily the case that colour changes are symmetrical from centre to the left / right or to upwards / downwards. This behaviour becomes especially important when a monitor is used in portrait (pivot) mode.

Test form 1 – Portrait

The portrait (page 1 in the PDF, see figure 2) allows to judge hue, chroma and gradation over the viewing cone. Look especially for possible gradation changes in the mid tones. The portrait should appear similar over the whole viewing cone. If the gradation ("gamma") is not stable over the viewing

cone a lightness change in the mid-tones will occur (see figure 5). Note that the visual assessment of the viewing cone can not clearly separated from possible uniformity issues and therefore have to be mutually judged (see section 3).

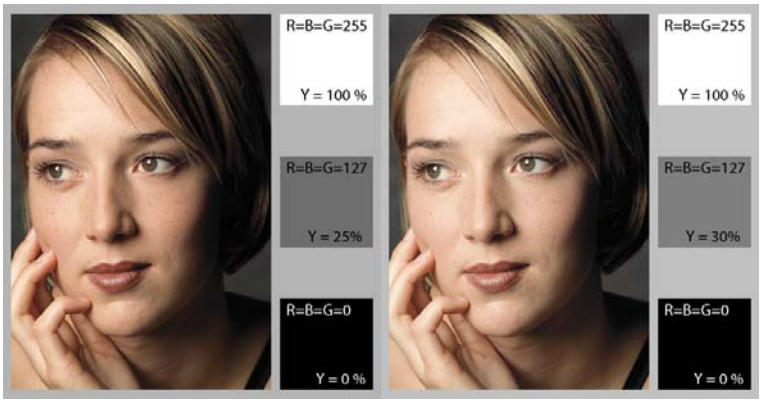

Figure 5: Example of changing gradation ("gamma") - especially prominent in the mid tones. A relative lightness difference of 20 % [(0,25 / 0,30) - 1] is simulated in this figure. Tone value differences in the mid tones of 10 % are clearly visible. A detailed description regarding "stable gamma" is found in the Fogra research report 10.047 (German only).

Test forms 2 to 4 – Low-Key

The test forms 2 to 4 are low-key pictures – pictures with mainly dark tones. They allow the visual assessment of the viewing cone characteristics in the shadows. The most significant difference between the viewing cone characteristics of different monitor types are usually observed in the shadows. Look for the colour in the wrist straps of the watches (test form 3 and 4). Test form 2 is especially suited to assess the gradation. The brightening on the left side of the test picture should appear similar in size and strength in all repeated test forms over the complete viewing cone.

Test forms 5 and 6 – Stripes

Both test forms allow judging the vertical viewing cone (especially important for portrait mode). The alternating coloured stripes should appear with the same lightness and chromaticity over the screen area.

Test forms 7 and 8 – White and Light Grey

The white or light grey full screen colours (test forms 7 and 8) can be used to check if the monitor appears with the same lightness in all screen areas.

3. Uniformity

The first 11 test forms are suited to check the uniformity over the screen area, while test forms 1, 5 and 7 to 11 are suited particular for this task. Because a potential viewing angle dependency of colours will superpose the judgement of the uniformity it is a good idea to evaluate the uniformity – in addition to the default viewing distance – at a longer viewing distance (> 1 m). Then the uniformity

can be separated from the viewing cone characteristics, because the screen is seen under a smaller viewing angle [2].

Test form 1 – Portrait

The portrait motive gives allows assessing hue and chroma as well as gradation ("stable gamma") over the viewing area.

Test form 5 – Stripes

For testing stripes it has been experienced that yellow-orange (skin) like colours are very sensitive. They are also known as "peach puff colours" and will be used in test form 5.

Test forms 7 to 11 – achromatic colours

Test forms 7 to 11 can be used to judge the rendering of achromatic colours . The test forms "white", "light grey" and "grey" are useful to detect lightness or chromatic colour differences over the screen area.

4. Pixel failures

Test forms 7, 11 (White, Black) and 12 – 14 (Red, Green, Blue)

To check the monitor for pixel failures, that means constant glowing or defective pixels a full screen black or white test forms are used. Sub pixel, failures where only a part of an RGB pixel is defective, can be detected with the red, green or blue test forms [1].

5. Artefact "Black Mura"

The phrase "artefact" is used here to describe all flaws in a picture, which currently cannot be assessed objectively in a practical way. One possible artefact noticed on some computer screens is a light leakage at the border of the screen, which appears as cloudy looking lightened screen parts, which should be dark. In the monitor industry this problem is often called "Mura" (Japanese for error). This effect is normally introduced due mechanical tensions of panel mounted in the front bezel. The problem is most visible when viewing the black test form 11 (see figure 6).

Figure 6: Example for serious "mura" effect – Light leakage becoming visible at the edges of the display. (The photo shown here is overexposed for better illustration).

6. "Ghost pictures"

Some monitors exhibit an after-picture when a static content was shown for a longer time span. This becomes visible when changing the displayed image content. This problem can be typical for a monitor series, but always depends on the characteristics of the single sample, because the different monitors from the same series can be affected quite different in this regard. For example one monitor might show the effect clearly while a second sample might not show any effect at all. Check for potential problems by showing the test form 15 for a certain time span. Then switch to a middle grey (test form 9). A possible "ghost picture" will still give the impression of the checkerboard pattern of contained in test form 15 (see figure 7).

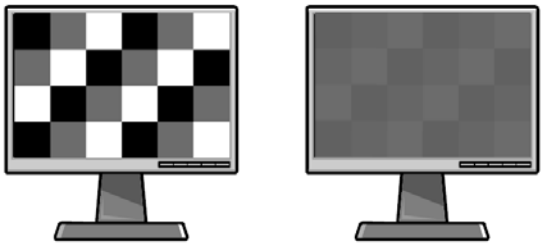

Figure 7: Test form 15 (left) to check for so called "ghost pictures". This test form is displayed for a specific time span. On the right is a simulation how the effect might look like, when switching to a grey full screen (test form 9), which should show no checkerboard pattern for a monitor not affected by this problem.

It is important to note that this "ghost picture" will disappear when a uniform colour or constantly changing display content is shown or when the monitor is turned off. The test time to display the checkerboard pattern as well as a potential rest time when switching to the uniform grey test form should correlate to your typical usage and mirror how long static content might be displayed on the monitor. A typical test time for "burn-in" might be 30 minutes and then switching to grey while and to visually assess the effect immediately without a rest time. This example could simulate to have palettes in an image processing programme displayed static and then switching to full screen mode.

7. Reference

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http://www.behardware.com/articles/615-1/lcds-with-persistent-images.html,
Stand: June 2009

8. Copyright note

We thank the following photographers and copyright holders for the right to use the test forms in this test file and for the assistance in choosing suited test motives:

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